

PATENT COOPERATION TREATY

09 JUL 2004

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

MARKS & CLERK
4220 Nash Court
Oxford Business Park South
Oxford Oxfordshire OX4 2RU
GRANDE BRETAGNE

RECEIVED
- 4 MAY 2004
MARKS AND CLERK

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing
(day/month/year) 03.05.2004

Applicant's or agent's file reference
AMS.P51884WO

IMPORTANT NOTIFICATION

International application No.
PCT/GB 03/00052

International filing date (day/month/year)
09.01.2003

Priority date (day/month/year)
11.01.2002

Applicant
WESTERNGECO SEISMIC HOLDINGS LIMITED

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international
preliminary examining authority:



European Patent Office - P.B. 5818 Patentaan 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Authorized Officer

Adam, G

Tel. +31 70 340-4133





PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AMS.P51884WO	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA416)	
International application No. PCT/GB 03/00052	International filing date (day/month/year) 09.01.2003	Priority date (day/month/year) 11.01.2002
International Patent Classification (IPC) or both national classification and IPC G01V1/36		
Applicant WESTERNGECO SEISMIC HOLDINGS LIMITED		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input checked="" type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 01.08.2003	Date of completion of this report 03.05.2004	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Lorne, B Telephone No. +31 70 340-1002 	

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/GB 03/00052**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-19 as originally filed

Claims, Numbers

1-20 as originally filed

Drawings, Sheets

1/8-8/8 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/GB 03/00052**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:

- ☐ restricted the claims.
☒ paid additional fees.
☐ paid additional fees under protest.
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
☐ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-20
	No: Claims	
Inventive step (IS)	Yes: Claims	1-20
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-20
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item IV

Lack of unity of invention

1. This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-7,10-15

A method of (and the corresponding apparatus for) processing multi-component seismic data comprising the step of selecting a portion of the seismic data either containing only events arising from critical refraction of seismic energy or containing only upwardly propagating seismic energy.

2. Claims: 8-9,16-20

A method of (and the corresponding apparatus for) processing multicomponent seismic data comprising the step of determining calibration filters from 2 portions of the seismic data with different offset ranges.

The prior art (K.M. Schalkwijk et al, "Application of two-steps decomposition to multicomponent ocean-bottom data : theory and case study") discloses a method of (and the corresponding apparatus for) determining a calibration filter $a(f)$ between the pressure and vertical velocity component. A window A (page 271) is chosen that contains mainly primary reflections (with the condition, that there should be no primary reflections present in the decomposed downgoing wavefield above the bottom). Therefore, all primary reflection energy is moved to the upgoing wavefield.

From the above, the following objective problem can be formulated as : -the automatic picking of seismic data containing only upwardly propagating seismic energy above the seafloor.

This problem is solved by the features of the first set of claims that are not disclosed by the prior art document.

The Special Technical Feature of subject 1 as defined in Rule 13(2) PCT is :

-the selection of seismic data containing only events arising from critical refraction.

The second set of claims yields the non-disclosed potential Special Technical Feature as defined in Rule 13(2) PCT (which has not been disclosed in the prior art document) of :

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/00052

-the determination of calibration filters from 2 portions of the seismic data with different offset ranges.

The problem to be solved could thus be said to be the provision of a wavenumber-dependent calibration filter.

On the face of it, there are no technical features in the claimed invention, which can be seen as common or corresponding special technical features within the meaning of Rule 13(2) PCT.

In determining a possible relationship between these 2 subjects, such as a common inventive concept, we find that the provision of :

a wavenumber-dependent calibration filter does not contribute to the desire of the automatic picking of seismic data containing only upwardly propagating seismic energy above the seafloor.

And the selection of seismic data containing only events arising from critical refraction does not allow for the provision of a wavenumber-dependent calibration filter.

No further features are available by means of which a relationship between the subjects of the 2 sets of claims may be established.

Consequently, neither the objective problems underlying the subjects of the 2 claimed inventions, nor their solutions defined by the (special) technical features allow for a relationship to be established between said inventions.

In conclusion, therefore, the 2 groups of claims are not linked by common or corresponding special technical features and define 2 different inventions not linked by a single general inventive concept.

The application therefore does not meet the requirements of Unity of Invention as defined in Rule 13(1) and 13(2) PCT.

First invention :

Claims 1-7,10-15,17,19,20

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Claims 1,10 (and corresponding apparatus claims 14,15) do not meet the requirements of Article 6 PCT for the following reasons :

-these claims have been drafted as separate independent method claims (and respective apparatus claims), they appear to relate effectively to the same subject-matter [the selection of a first portion of the seismic data (first arrival) containing only upwardly propagating seismic energy above the seafloor] and to differ from each other only with regard to the definition of the subject-matter for which protection is sought [critical refraction events or any other events containing only upgoing propagating seismic energy] . The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, claims 1,10 (and corresponding apparatus claims 14,15) do not meet the requirements of Article 6 PCT.

2. Reference is made to the following document

D1: SCHALKWIJK K.M ET AL.: 'Application of two-step decomposition to multicomponent ocean-bottom data : theory and case study' JOURNAL OF SEISMIC EXPLORATION, no. 8, 1999, pages 261-278, XP008017686 cited in the application

The document D2 was not cited in the international search report. A copy of the document is appended hereto.

D2: SHERIFF R.E. : 'Encyclopedic dictionary of Exploration Geophysics' page 45, fig.C-15

3. Document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and teaches a method of processing multi-component seismic data obtained from seismic signals propagating in a medium (page 267). A window A is chosen that contains mainly primary reflections and a calibration filter $a(\omega)$ is determined from this

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/00052

window A of the seismic data. This calibration filter is used to calibrate a first component of the seismic data relative to a second component of the seismic data.

The subject matter of claim 1 (and the subject matter of the corresponding apparatus claim 14) and dependent claims 2-7, 12, 13, 19, 20 are therefore novel (Article 33(2) PCT).

The subject matter of claim 1 of the present invention differs in that the selected portion of the seismic data contains only events arising from a critical refraction of seismic energy instead of primary reflections.

It is known for the skilled man that waves involving energy which enters a high-velocity medium (refractor) with an angle \geq the critical angle, travel in the high-velocity medium nearly parallel to the reflector surface and that the critical refraction event will consist only of upwardly propagating seismic energy above the seafloor.

This critical angle is related to the offset (critical distance) at which the reflection time equals the refraction time, and as this offset becomes \geq the crossover distance (see for example D2), the refracted event becomes the first break.

D1 is directed to the use of a window in which the seismic data contain mainly primary reflections in order to resolve $a(\omega)$ but there is no reference in D1 to use a time window containing critical-refraction events or other first arrival containing only upgoing energy above the seafloor.

Therefore, there is no hint for the skilled man in regards with D1 to consider a time window containing first arrival with only upgoing energy above the seafloor.

D2 is a general definition of critically refracted events in seismic data and does not specifically relate to wavefield decomposition.

Thus the subject matter of claim 1 (and the subject matter of the corresponding apparatus claim 14) and dependent claims 2-7, 12, 13, 19, 20 involve an inventive step (Article 33(3)PCT).

Independent method claim 10 (and the corresponding apparatus claim 15) are as well related to selecting a portion of the seismic data in which the first arrival contain only upwardly propagating seismic energy.

Therefore the subject matter of claims 10, 11, 15 is novel and involves an inventive step (Article 33(2)(3)PCT).

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/00052

Second invention :

claims 8,9,16,18

Reference is made to the following document:

D1: SCHALKWIJK K.M ET AL.: 'Application of two-step decomposition to multicomponent ocean-bottom data : theory and case study' JOURNAL OF SEISMIC EXPLORATION, no. 8, 1999, pages 261-278, XP008017686 cited in the application

The invention relates to a method (and the corresponding apparatus) of designing a calibration filter which depends on the wavenumber as well as on the frequency in order to calibrate a first component of the seismic data relative to a second component of the seismic data.

Document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and teaches a method of processing multi-component seismic data obtained from seismic signals propagating in a medium (page 267). A window A is chosen that contains mainly primary reflections and a calibration filter $a(\omega)$ is determined from this window A of the seismic data. This calibration filter is used to calibrate a first component of the seismic data relative to a second component of the seismic data. The calibration filter proposed in this method is dependent only on frequency.

The subject-matter of independent method claim 8 and dependent claim 9 is therefore novel (Article 33(2) PCT).

It is known from document D1 to resolve the calibration filter $a(\omega)$ between the pressure and vertical velocity from primary reflection events for one offset (corresponding to the window containing primary reflections). The determination of a calibration filter for another offset containing only critical refraction events does not appear to involve an inventive step (see reasoning for the first invention).

However, the solution presented in claim 8 with the combination of several calibration filters for long and short offsets in order to design only one calibration filter which can be used for any offset has not been disclosed nor hinted in cited prior art documents and does not seem to be obvious for the skilled man.

Therefore, the subject-matter of independent method claim 8 and dependent claim 9

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB03/00052

appears to involve an inventive step (Article 33(3) PCT).

For the same reasons, the corresponding apparatus claims 16,18 are novel (Article 33(2) PCT) and inventive (Article 33(3) PCT).